

Applicants' invention as set forth in amended claim 1 relates to an improvement in a process for the polymerization or copolymerization in the gas phase of olefin(s) by bringing the olefin(s) into contact, under polymerization or copolymerization conditions in a reactor in which the polymer or the copolymer is maintained in a fluidized bed and/or agitated with mechanical stirring, with a catalyst system, the improvement comprising, prior to the introduction of the catalyst system in the reactor, subjecting the reactor to a cleaning treatment that includes the steps of introducing into the reactor an alkane having from 4 to 8 carbon atoms, circulating said alkane across the reactor under pressure and elevated temperature, and then depressurizing and purging the reactor of the alkane, wherein the quantity of alkane used for the cleaning treatment is such that the alkane partial pressure is between 25 and 95% of the saturated vapor pressure of the alkane under the temperature and pressure treatment conditions.

The alkane used in the cleaning treatment of the claimed process is, therefore, necessarily in the vapor phase. This is because if the alkane partial pressure is below the saturated vapor pressure of the alkane under the temperature and pressure treatment conditions as set forth in the claim, the alkane is necessarily in vapor form.

As discussed in the specification, Applicants unexpectedly found that this alkane treatment leads to smooth and improved polymerization start-ups of the polymerization process as shown in the Example. See page 3, lines 9-15 of the specification.

Wirth relates to high green strength rubbers, which can be prepared by polymerization in solution or in liquid phase in an inert solvent in the presence of a Ziegler type catalyst (see col. 2, lines 10-18, col. 3, lines 15-17 and Examples 1 and 2 of Wirth).

The Examiner references Example 1 of Wirth as disclosing a rinsing step using hexane in the process. While the Examiner acknowledges that this rinsing step is not at an elevated pressure, he argues that this would be obvious in view of Durand which discloses pressurizing to an elevated pressure and degassing with nitrogen to reduce water content in a gas-phase reactor.

However, it is submitted that Applicants' invention as set forth in main claim 1, is not obvious over this combination of references for the following reasons.

First, Applicants claimed process, as set forth in claim 1, is an improvement in a "process for the polymerization or copolymerization in the gas phase of olefins . . . in a reactor." (Emphasis added).

On the other hand, Wirth does not relate to a gas phase polymerization or co-polymerization process as required by the claims, but to a solution phase process. In contrast, Durand, as the present invention, relates to a gas-phase process. Thus it is not believed there would be any motivation to combine the teachings in respect of the individual reactors and processes of Wirth and Durand in the first place, let alone in the manner in which the Examiner has combined them.

Secondly, Wirth uses the language "rinsing." While the Examiner argues that this is equivalent to the claimed step of "circulating" the alkane across the reactor, the term "rinsing" by definition means that the alkane is in liquid form. See col. 3, lines 52-53 of Example 1 of Wirth where it is disclosed that the reactor "was assembled, rinsed with dry hexane and purged overnight with dry nitrogen." Hexane has a boiling point of 69°C and the reactor "overnight" is obviously near or at room temperature. Hence the hexane

would have to be in liquid form. In contrast, when the alkane is circulated in the gas-phase reactor in the present invention the alkane is necessarily in vapor form.

The Examiner does not appear to appreciate this difference between the solution polymerization process of Wirth on the one hand and the gas-phase polymerization process of Durand and the invention on the other, because he argues that it would have been obvious, in view of Durand, to perform the “rinsing” of Wirth under pressure and at an elevated temperature. It is apparent that the Examiner has reached this conclusion under the mistaken assumption that both Wirth and Durand relate to polymerization in the “gas phase,” thus apparently believing that the hexane of Wirth could be influenced by the pressure and temperature conditions of Durand. See page 4 of the Office Action, lines 7-13 and last two lines. However, this is not true because Wirth, in contrast to Durand and the present invention, relates only to a polymerization process “in the liquid phase” and the hexane is necessarily in liquid form. Moreover, what advantage or difference would occur if the rinsing step of Wirth with a liquid alkane was done under pressure? Thus it is submitted that circulating with alkane vapor is not the same as rinsing with liquid alkane.

Thirdly, Durand's pressurizing/depressurizing steps relate to the nitrogen purge of the reactor, not an alkane. Thus even if a skilled person was somehow able to combine Wirth and Durand, they could not arrive at the present invention. More specifically, the liquid rinsing of Wirth is clearly a pre-purge step, performed immediately after assembling the reactor and before a conventional nitrogen purge to remove air (overnight in the case of the Examples). Durand, when describing the start-up of the polymerization reactor at page 18, lines 29-35, describes a reactor already assembled

and under a nitrogen atmosphere, which is then subject to nitrogen purge operations. Thus, were the skilled person to understand anything from the teachings of Durand regarding the use of purges in a reactor according to Wirth, it would be that the “pressurized” nitrogen purges of Durand could be performed instead of or after the overnight nitrogen purge at atmospheric pressure taught by Wirth.

There is nothing in Durand that teaches how one could modify the liquid alkane rinsing step of Wirth to arrive at Applicants claimed circulating step with alkane in vapor form. To suggest it could be used with the pressuring/depressuring steps that Durand uses with nitrogen, is not only hindsight based on reading of Applicant’s specification, but would make no sense because the alkane is in liquid form. As noted in M.P.E.P §2142 “impermissible hindsight must be avoided and the legal conclusion [of obviousness] must be reached on the basis of facts gleaned from the prior art.” (Emphasis added).

Neither Wirth nor Durand teaches the use of an alkane in vapor form in a cleaning treatment for a gas phase reactor. This is not only a key feature of Applicants’ invention, but is not gleanable from either reference. Thus a claimed element is clearly missing from both the cited references.

As noted in the Declaration of Mr. Bell in paragraphs 9 and 10, in his opinion, he also believes that a skilled person would not combine the teachings in respect of the individual reactors and processes of Wirth and Durand because they relate to distinct processes.

Moreover, that rinsing with liquid alkane as taught by Wirth is not applicable to a gas phase reactor system. In particular, the volume of an industrial reactor system

would typically be 1000 - 1500m<sup>3</sup>. The practical aspects of filling the reactor and associated pipework, exchangers and compressor with very large volumes of hazardous alkanes at elevated temperature and pressure, and then circulating the alkane, rule out industrial application of a liquid rinse of a gas phase reactor system. Further, the reactor cannot normally be isolated from the associated large-bore pipework and even treatment by liquid rinsing smaller subsystems is therefore not practical.

In the Advisory Action of December 4, 2001, the Examiner comments that "rinsing," as used in Wirth, "does not mean that the liquid does not have a partial pressure . . . [and] . . . "that the hexane [of Wirth] can be both liquid and vapor [and] co-exist in the reactor in an equilibrium." In other words, that the liquid used in Wirth would in any case have a vapor phase associated with it.

However, as noted by Mr. Bell in paragraph 12 of the Declaration, the present claims require the quantity of alkane used for the treatment to be such that the alkane partial pressure is comprised between 25 and 95% of the saturated vapor pressure of the alkane under the temperature and pressure treatment conditions. Under these conditions, no liquid phase of the alkane can be present, and thus the rinsing with liquid alkane, even if there were a vapor phase associated therewith, is not in any way comparable or equivalent to the process as presently claimed. Moreover, the believed mechanism claimed for the benefits of the current invention, as described at page 3, lines 9-15 of the specification, is different from that that one would associate with a liquid rinse.

In the Advisory Action of December 4, 2007, the Examiner also argues that Applicants should provide comparative data showing the criticality of the claimed partial pressures compared to the prior art.

However, as noted by Mr. Bell in paragraphs 14 and 15 of the Declaration, it is not possible to provide comparative data with rinsing with alkane as taught by Wirth but applied to a gas phase reactor because, as noted above, it is not practical to use a liquid to rinse a gas phase reactor. Because of this, and as noted above, the skilled person would not combine the rinsing step of Wirth with the gas phase process of Durand to obtain the process of the present claims.

In further support of the patentability of the claimed process, Mr. Bell presents experimental data in Figures 1 and 2 attached to the Declaration that show the benefits of the cleaning treatment of the process of the present invention with an alkane vapor compared to a more conventional process start-up without a depressuring step. See paragraphs 17-19 of the Declaration.

As noted therein, the data presented in Figures 1 and 2 shows, respectively, the measurements from temperature probes located in the vicinity of the fluidization grid for a comparative example compared to one according to the present invention. Variations of such temperature measurements are known to correlate to the presence of agglomerates in the reactor.

Figure 1 shows the temperature measurements obtained in the hours after start-up of a polymerization reaction not according to the present invention. During this start-up, the catalyst bed in the reactor was fluidized and then the pressure increased to reaction pressure (approx. 23 bars) over the course of approximately 9 hours. During

this time pentane was introduced into the reactor and its partial pressure increased to 2.5 bars. No depressurization was carried out after the introduction of pentane prior to the introduction of catalyst (and the pentane was maintained in the reactor at approximately this pressure throughout the run). The reaction was then started and although the temperature measurements shown in Figure 1 were initially fairly smooth, variations soon started to appear. Approximately 18 hours after start-up these variations were very agitated, varying frequently and significantly. Subsequently, agglomerates caused a reactor shut-down after less than 24 hours operation.

For comparison, Figure 2 shows the temperature measurements obtained in the hours after start-up of a polymerization reaction according to the present invention. The start-up was similar to the start-up described above, the catalyst bed in the reactor being fluidized and then the pressure increased. In this case, however, after the pentane partial pressure has been increased to approximately 2 bars (at a total reactor pressure of approx. 16 bars), the reactor was depressurized and the pentane purged therefrom, and the reaction pressure then built up to reaction pressure of 23 bars (with approx. 2.5 bars pentane). The temperature measurements shown in Figure 2 show a much lower variance (note that the scale is significantly different to Figure 1) showing much more constant temperatures. Figure 2 shows 48 hours operation, but, in fact, the process in this Example operated for more than 10 days without need to stop the reactor due to agglomerates formation.

As concluded by Mr. Bell in paragraph 20 of the Declaration, these results are typical of those obtained from a number of polymerization runs. In fact, since the introduction of a cleaning step comprising introducing an alkane and subsequently

depressurizing according to the process of the present invention the number of successful start-ups on the reactor used for the above examples has increased from about 50-70% to 100%.

For all of the above reasons, sufficiently documented by the Declaration of Mr. Bell, it is submitted that the combination of Wirth and Durand does not establish a prima facie case of obviousness of the claims as required by M.P.E.P. §2142 and §2143.

Withdrawal of the rejection under §103(a) based on Wirth in view of Durand and allowance of claims 1-9 and 11-16 is therefore requested.

Please grant any extensions of time required to enter this response and charge any additional required fees to Deposit Account 06-0916.

Respectfully submitted,

FINNEGAN, HENDERSON, FARABOW,  
GARRETT & DUNNER, L.L.P.

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By: 

Arthur S. Garrett  
Reg. No. 20,338  
(202) 408-4091

**Attachment: Declaration of Mr. Andrew David Bill**

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